

## **An Introduction to the Spallation Neutron Source**

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# The Spallation Neutron Source



[www.sns.gov](http://www.sns.gov)



- The SNS will begin operation in 2006
- At 1.4 MW it will be ~8x ISIS, the world's leading pulsed spallation source
- The peak thermal neutron flux will be ~50-100x ILL
- SNS will be the world's leading facility for neutron scattering
- It will be a short drive from HFIR, a reactor source with a flux comparable to the ILL

May 7-9, 2002

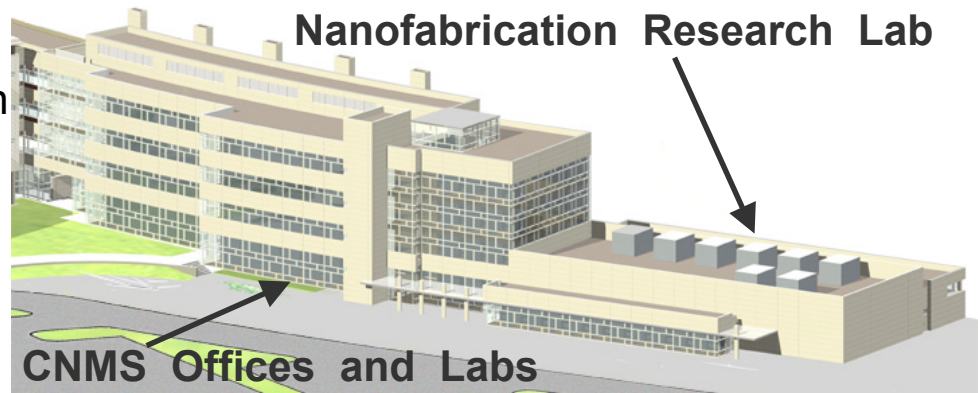
## Scientific Scope and Vision for CNMS

# Center for Nanophase Materials Sciences



- A **highly collaborative** and **multidisciplinary** research center
- **Co-located** with the Spallation Neutron Source (SNS) and the Joint Institute for Neutron Sciences (JINS) **on ORNL's "new campus"**
- **JINS**: Housing and dining facilities, auditorium, classrooms, for research visitors and students
- **SNS**: Will provide access to unique neutron scattering capabilities for nanoscience
- **CNMS**: Provides urgently needed capabilities for materials synthesis, nanofabrication, and modeling

***The CNMS Concept:***  
**Create *scientific synergies***  
***to accelerate discovery***  
***in nanoscale science***





# SNS - Guiding Principles

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- SNS will provide high availability, high reliability operation of the world's most powerful pulsed neutron source (cf white paper)
- It will operate as a User Facility to support peer reviewed research on a Best-in-Class suite of instruments
  - Research conducted at SNS will be at the forefront of biology, chemistry, condensed matter physics, materials science and engineering
- SNS will have the capability to advance the state of the art in spallation neutron source technology. This includes:
  - R&D in accelerators, target, and instruments to keep SNS at the forefront
  - Planned enhancement of SNS performance through upgrades of the complex and ongoing instrument development as part of the normal operating life of the facility

# Project Status

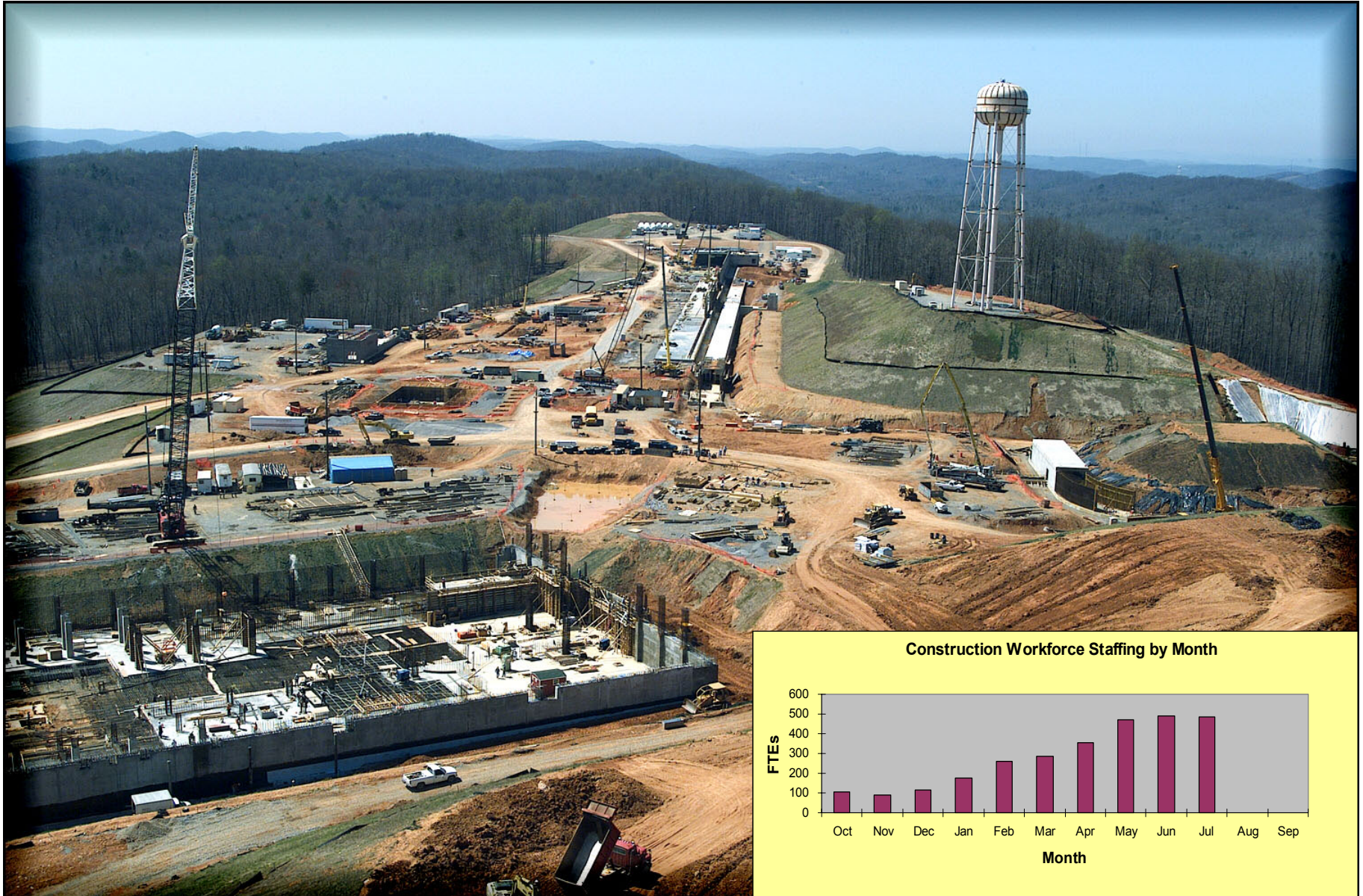
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- The FY 2002 request was \$291M, fully funded
- The FY 2003 request is \$225M, as anticipated
- Overall project design is 83% complete
- Overall the project is 49% complete (through August 2002) and within budget and schedule constraints
  - \$1.4B and June 2006 completion
- Significant site construction activities are underway
- There is good progress on all of the technical components: front end, superconducting linac, ring, target & instruments
- We continue to have excellent safety performance
  - >1,000,000 construction site work hours without lost workday injury
- Post-handoff MOAs signed with LBNL, BNL, draft LANL – others to follow, partner lab relations good
  - Working through issues

# SNS Site Global View

- Activities everywhere on site, multiple work fronts



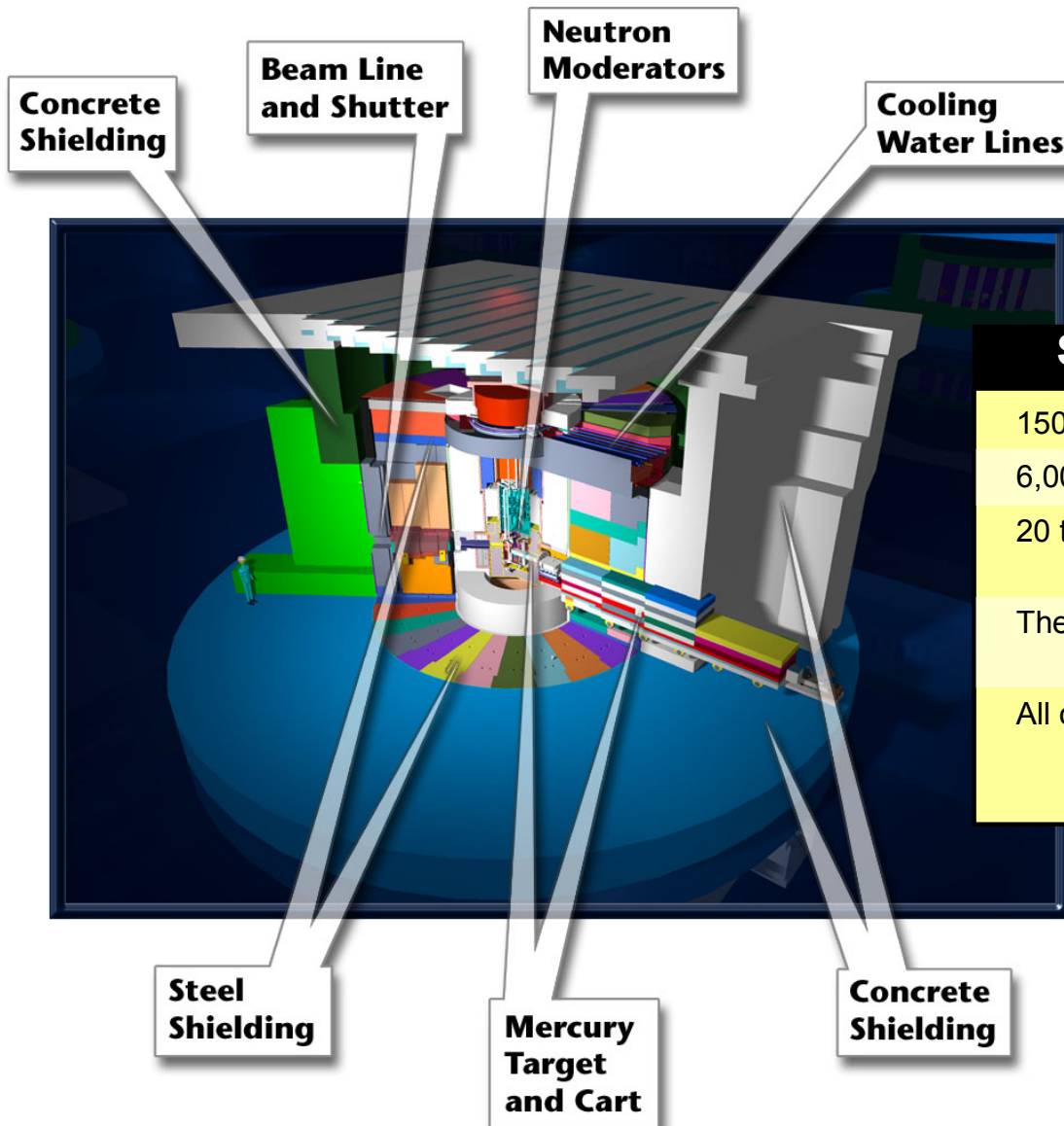


# SNS Construction



May 7-9, 2002

# Assembly of the Target Monolith



## Statistics on the Target Monolith

150,000 hours of engineering design

6,000 tons of steel, 1,200 tons of concrete

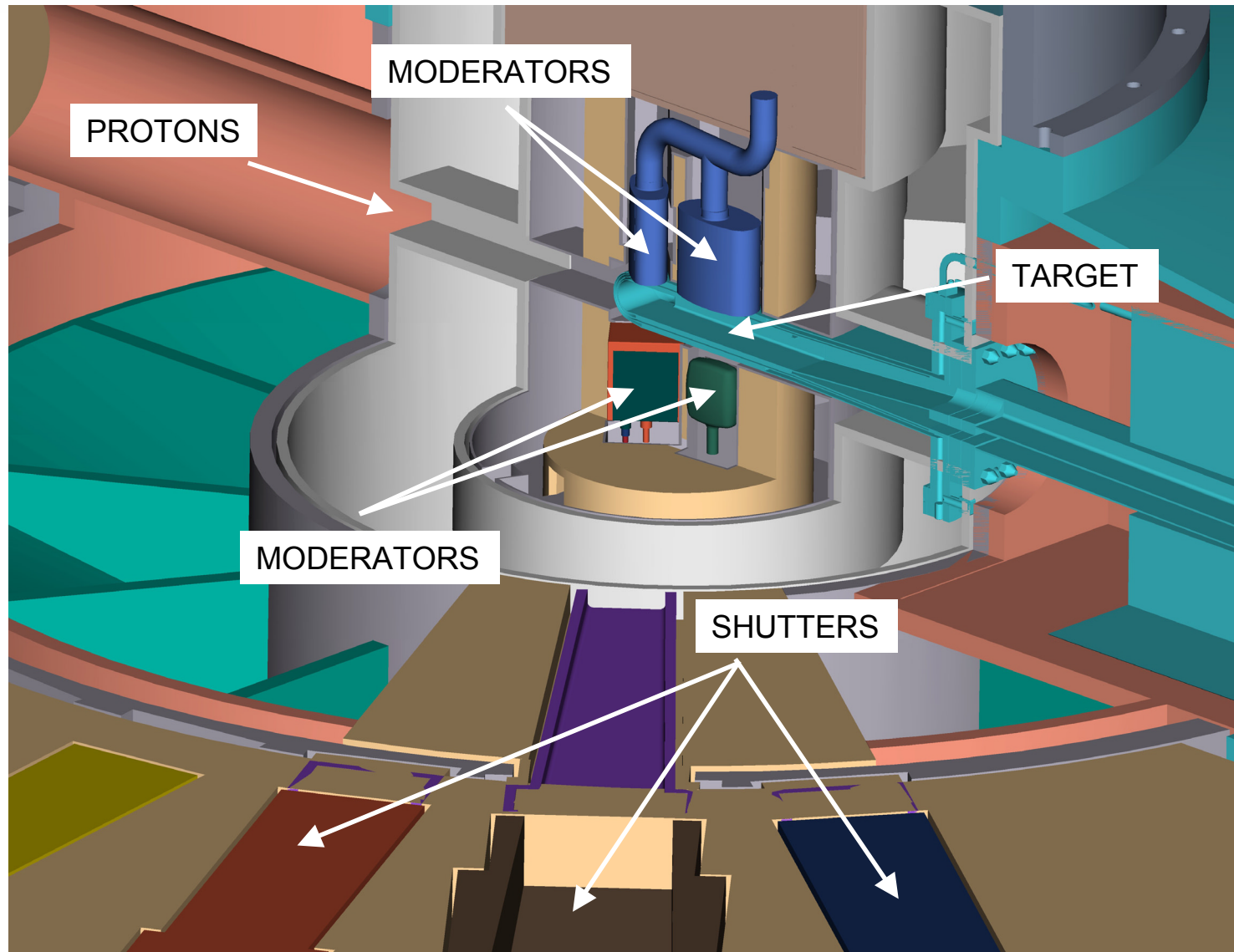
20 tons of mercury (proton beam target material)  
flowing at 300 gals/min.

The mercury cooling system handles enough energy  
to satisfy the requirements of 1,000 homes

All of this and more are required to produce the  
“light” (neutrons) for the most powerful  
“microscope” in the world

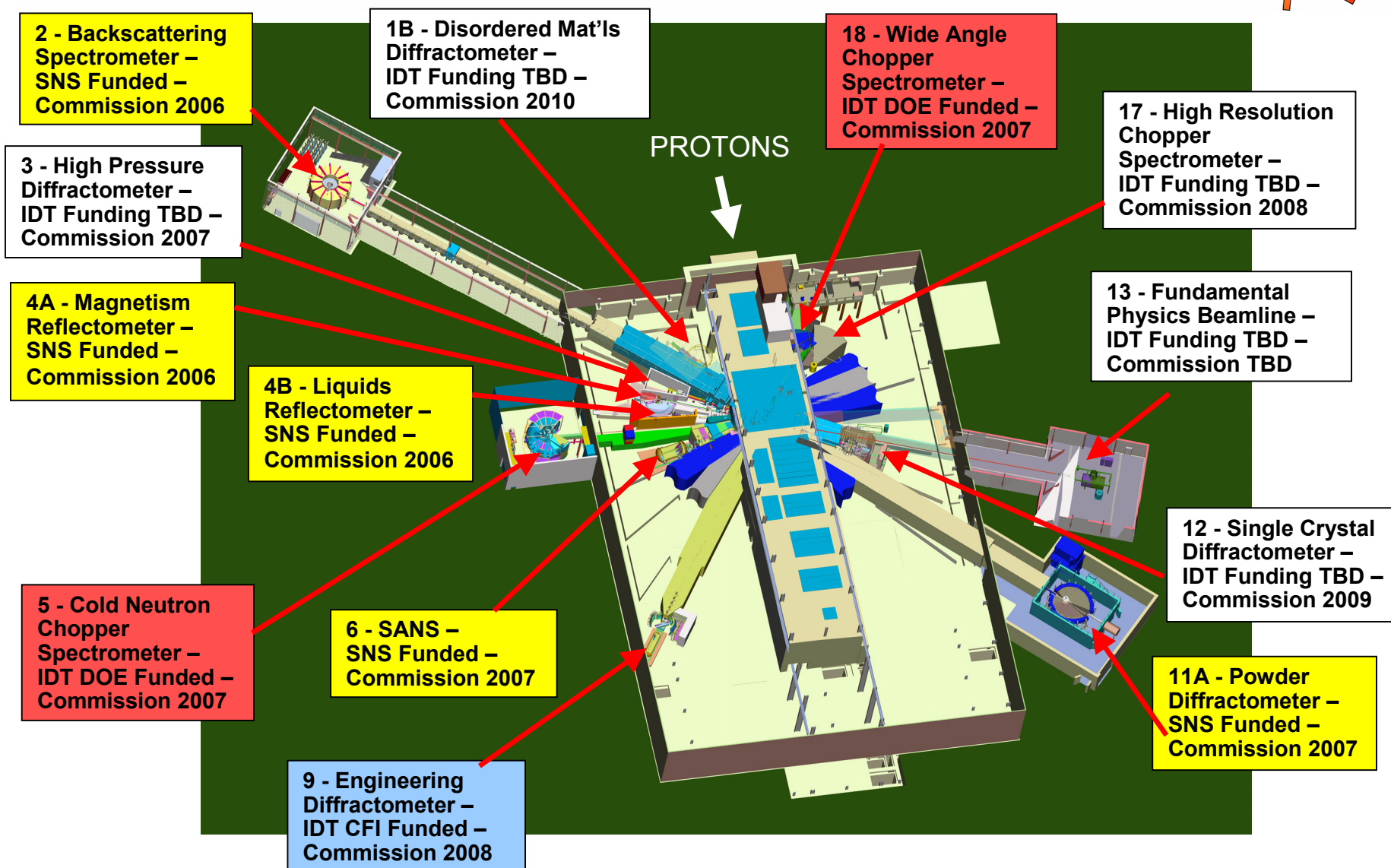


# Target Station



May 7-9, 2002

# SNS Instrument Layout



May 7–9, 2002



# Instrument status



- We are past half-way (13/24):
  - 5 instruments funded within the project
  - 3 funded IDT's: ARCS, CNCS, **Vulcan**
  - DOE/BES approved plan for phased funding of 4 additional instruments!
    - Sequoia, SCD, High Pressure diffractometer, Disordered Materials Diffractometer
  - Fundamental physics facility (2 instruments).
- 3 Instruments at Letter of Intent stage
  - HYSPEC                      ~~presentation~~                      approved
  - NSE (Julich)                      next EFAC
  - VISION                      next EFAC
- 1 new Letter of Intent
  - ASAP: Astrophysics, Symmetries and Applied Physics  
International collaboration (36 partners) proposing to use  
SNS epithermal flux to measure cross-sections

# Beam line allocation



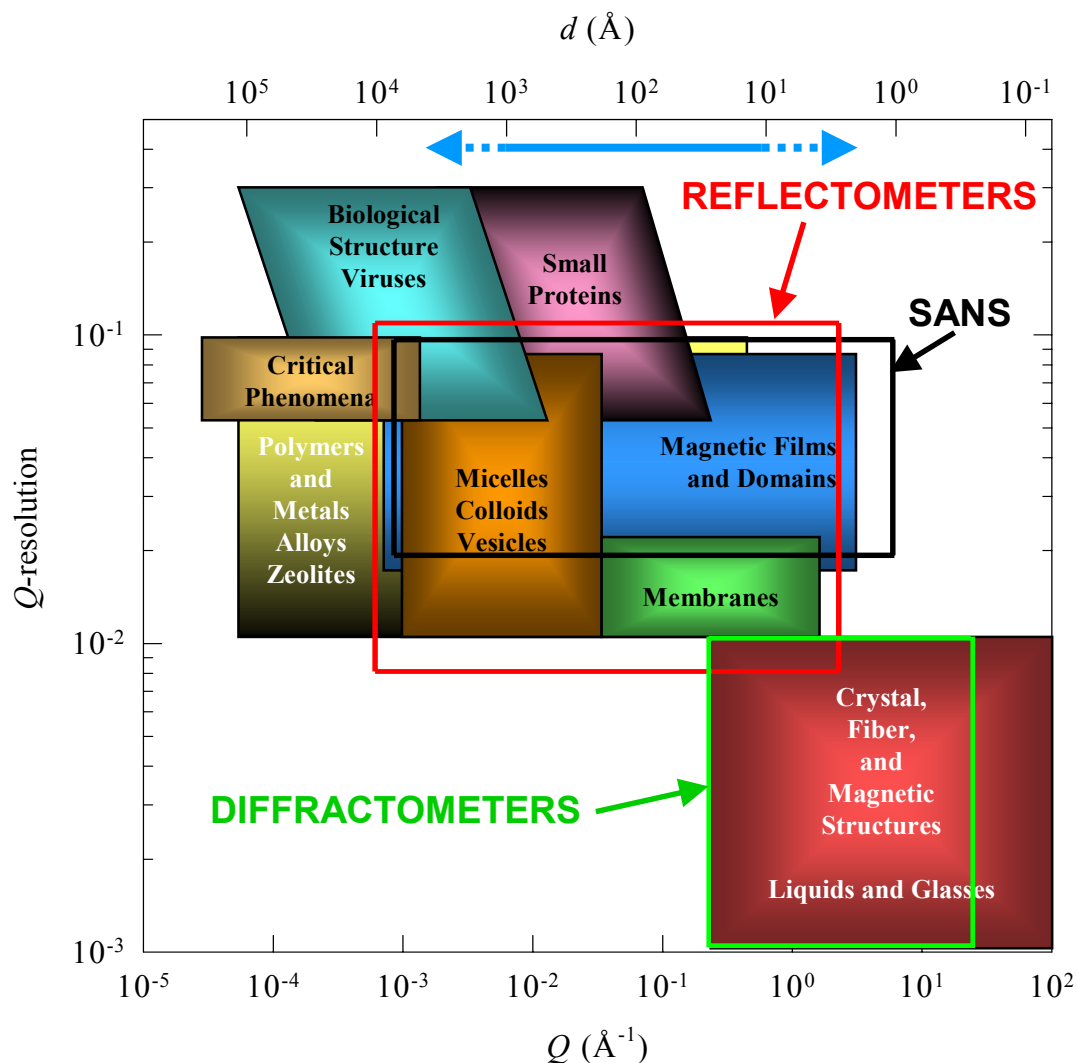
BL	Moderator		Instrument
1a	H <sub>2</sub>	decoupled, poisoned	Disordered Materials Diffractometer
1b	H <sub>2</sub>	decoupled, poisoned	
2	H <sub>2</sub>	decoupled, poisoned	
3	H <sub>2</sub>	decoupled, poisoned	
4a	H <sub>2</sub>	coupled	Magnetism Reflectometer
4b	H <sub>2</sub>	coupled	Liquids Reflectometer
5	H <sub>2</sub>	coupled	Cold Neutron Chopper Spectrometer
6	H <sub>2</sub>	coupled	SANS
7	water	decoupled, poisoned	Vulcan
8a	water	decoupled, poisoned	
8b	water	decoupled, poisoned	
9	water	decoupled, poisoned	
10	H <sub>2</sub>	decoupled, poisoned	Powder Diffractometer
11a	H <sub>2</sub>	decoupled, poisoned	
11b	H <sub>2</sub>	decoupled, poisoned	
12	H <sub>2</sub>	decoupled, poisoned	Single Crystal Diffractometer
13	H <sub>2</sub>	coupled	Fundamental Physics
14a	H <sub>2</sub>	coupled	Vision?
14b	H <sub>2</sub>	coupled	NSE?
15	H <sub>2</sub>	coupled	Hyspec
16a	water	decoupled, poisoned	Sequoia
16b	water	decoupled, poisoned	
17	water	decoupled, poisoned	
18	water	decoupled, poisoned	

Moderator Type	Number	Approved	LOI's	Available
H <sub>2</sub> decoupled, poisoned	8	5		3
H <sub>2</sub> coupled	8	6	2	0
Ambient water	8	3	1	4

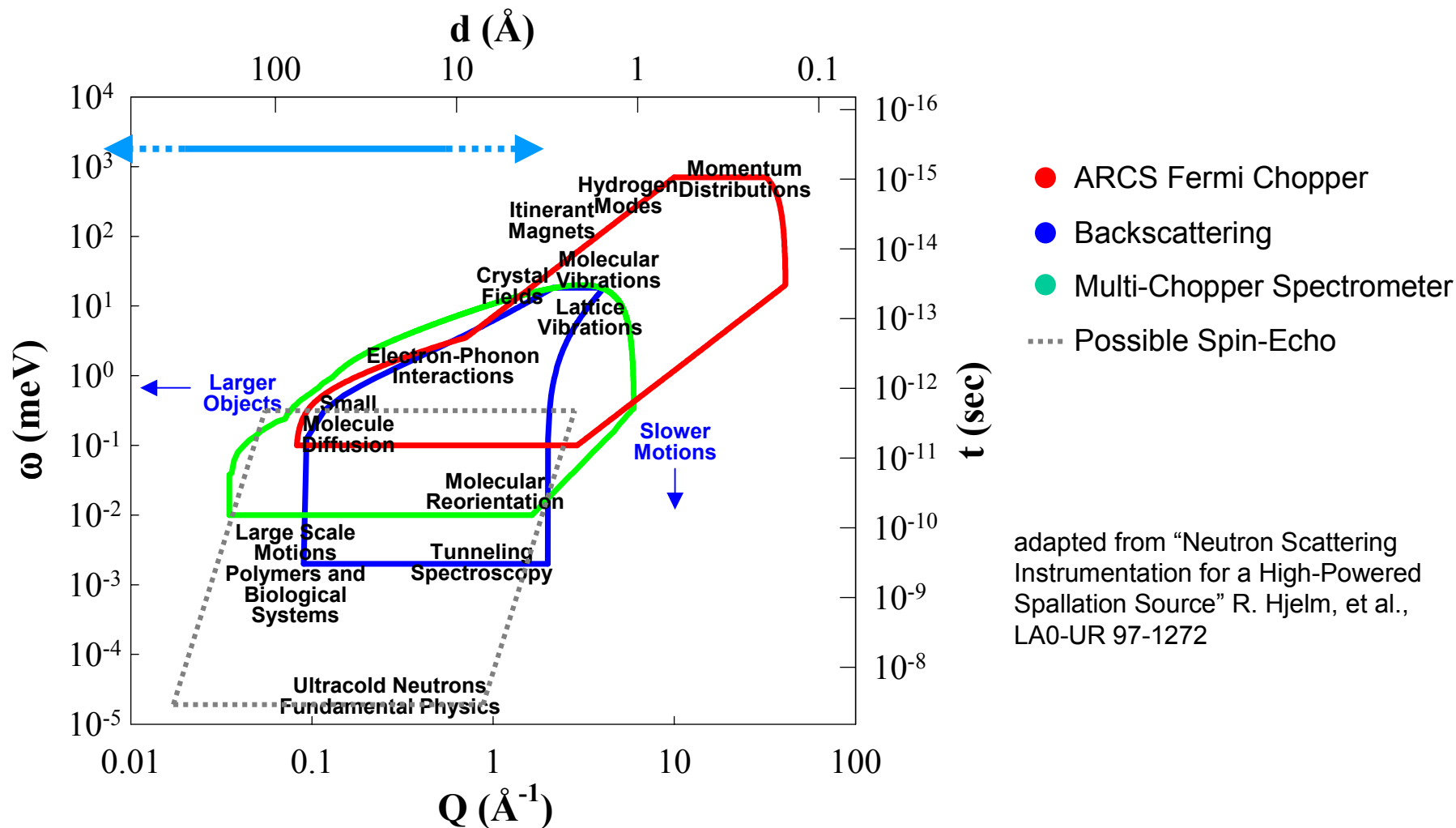
LOI's: NSE  
Vision  
ASAP



# Q-Resolution Diagram for Elastic Instruments



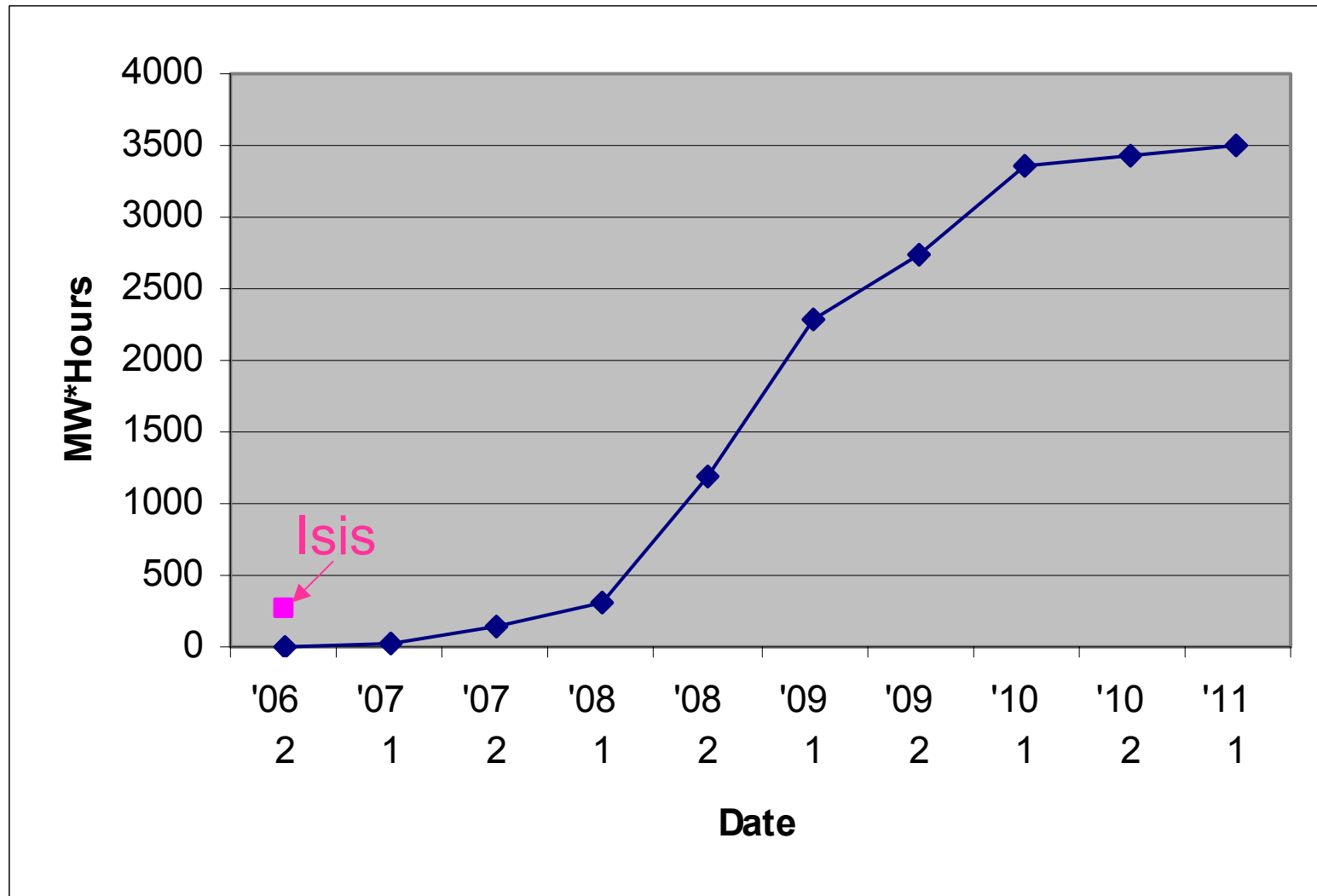
# Q- $\omega$ Space accessible for Inelastic Instruments



adapted from "Neutron Scattering Instrumentation for a High-Powered Spallation Source" R. Hjelm, et al., LA0-UR 97-1272



# Timeline for scientific productivity



# Scientific Input from the University Community



Since 1996, 50 workshops and conferences – more than 1000 attendees, representing over 100 universities, have provided input on SNS Instrumentation and science

## Recent and Upcoming JINS Workshops:

Materials Science and Engineering, 10/ 2001- 160 attendees

Biological Systems, 4/2002 – 100 attendees

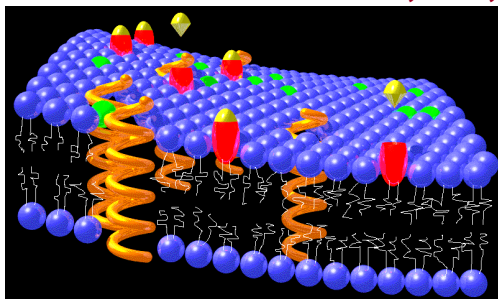
Solid State Chemistry and Earth Sciences, 3/2003

Neutrons and Nanoscience, 6/2003

Fundamental Neutron Physics, 4/2004

Major sponsors: *ORAU, UT, ORNL, UT-B univ.*

**First American Conference on Neutron Scattering,  
Knoxville, TN, 6/2002 – 409 attendees**



J. Katsaras and coworkers, doped “bicelle” system

## Sample outcome from JINS Workshops:

### JINS/ORAU/SNS/HFIR Structural Biology Task Force

**J. K. Blasie and S. H. White, co-chairs**

**Knoxville, Tennessee • June 23-27, 2002**

**ACNS**  
**American Conference on  
Neutron Scattering**

Sponsored by the National Neutron Centers, the Neutron Scattering Society of America (NSSA), and the Spallation Neutron Source and High Flux Isotope Reactor User Group (SHUG)

The conference will showcase recent scientific results in neutron science in a wide range of fields, including

- Soft condensed matter
- Biology
- Magnetism
- Materials science
- Chemistry and chemical physics
- Fundamental physics
- Source and instrumentation development

The conference will

- Include invited and contributed scientific talks and poster sessions
- Fulfill many of the objectives of a facility users meeting but on a national scale
- Highlight the capabilities of instrumentation available for users at the major neutron centers in North America

Visit our web site at [www.sns.gov/acns](http://www.sns.gov/acns)

The conference encourages the attendance of graduate students, postdocs, and new faculty, as well as established researchers in neutron scattering and allied disciplines. An application form for scholarships will be distributed on-line.

<b>Contacts:</b> Rob Briber, General Chair, <a href="mailto:rbriber@eng.umd.edu">rbriber@eng.umd.edu</a> Julie Borchers, <a href="mailto:julie.borchers@nist.gov">julie.borchers@nist.gov</a> Paul Butler, <a href="mailto:butlerpd@ornl.gov">butlerpd@ornl.gov</a> Al Ekkebus, local contact, <a href="mailto:ekkebusae@sns.gov">ekkebusae@sns.gov</a>	<b>Deadlines:</b> March 25, 2002 – abstract submission May 15, 2002 – early registration
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